

MODIS DATA SYSTEM STUDY

TEAM PRESENTATION

September 23, 1988

AGENDA

1. Further Analysis of the "Calibrate" Function as a System Sizing Benchmark
2. Functional Data Flows for the CDHF, DADS, ICC, and IST
3. Revised Context Diagrams and Data Dictionary for MIDACS
4. Action Items

FURTHER ANALYSIS OF THE "CALIBRATE" FUNCTION
AS A SYSTEM SIZING BENCHMARK

As one of the goals of the MODIS data system phase-B study, an accurate estimation of the size of the data system is crucial. This is being accomplished by breaking down the system into its component parts: the CDHF, DADS, TCMF, ICC, and IST. Each of these components is then broken down into its major functions, and each function expanded further, until it is possible to size each function accurately.

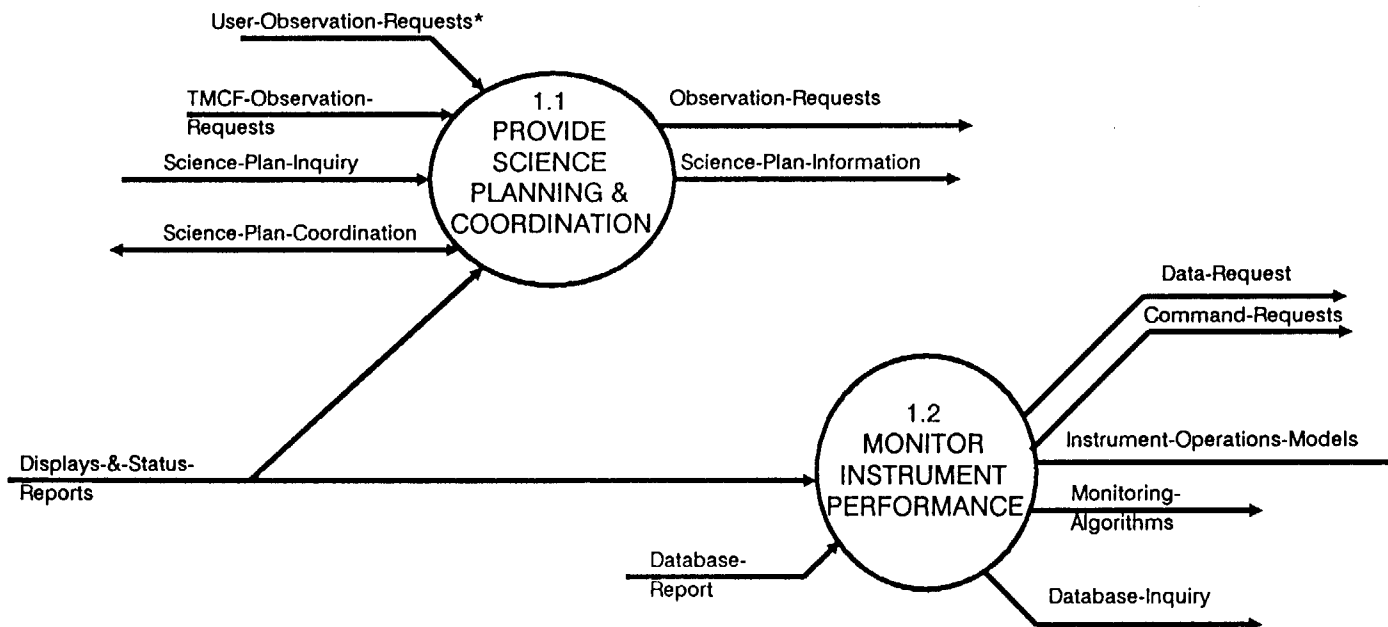
We previously presented one example of an algorithm used to provide a benchmark of one function of level-1 processing. The function examined was a (perhaps overly simple) linear calibration of the MODIS-T data from voltage counts to radiances. The expression chosen is of the form $y_i = a_i * x_i + b_i$. [The coefficients a_i and b_i are the calibration "constants," x_i is the detector voltage, y_i the calibrated radiance, and the subscript i denotes the detector number.] For this linear calibration of the MODIS-T data (including cycling through the loop), approximately 13 instructions are needed. The finding was that the NSESCC IBM 3081, under 100% utilization working 24 hours a day, would be unable, or barely able, to perform even this simple linear calibration function for the combined MODIS-N and -T data sets.

Here, we consider additional applications of this benchmark algorithm to the IBM 3081, the VAX 11/780, and the CYBER 205. Compiler optimization is considered on each machine, and the algorithm is run on the CYBER in both scalar and vector processing modes. The attached table presents the results of the benchmark runs for 1000 scan positions of the MODIS-T 64 x 64 detector array. The CPU time and an "effective" MIPS rating are both presented. The latter is obtained by dividing the estimated number of instructions ($13 \times 1,000 \times 4,096 = 53,248,000$) by the elapsed CPU time and scaling by 10^6 . In terms of CPU time for this function alone, it appears that the optimal system will be a compromise between the capabilities of the IBM 3081 and CYBER 205.

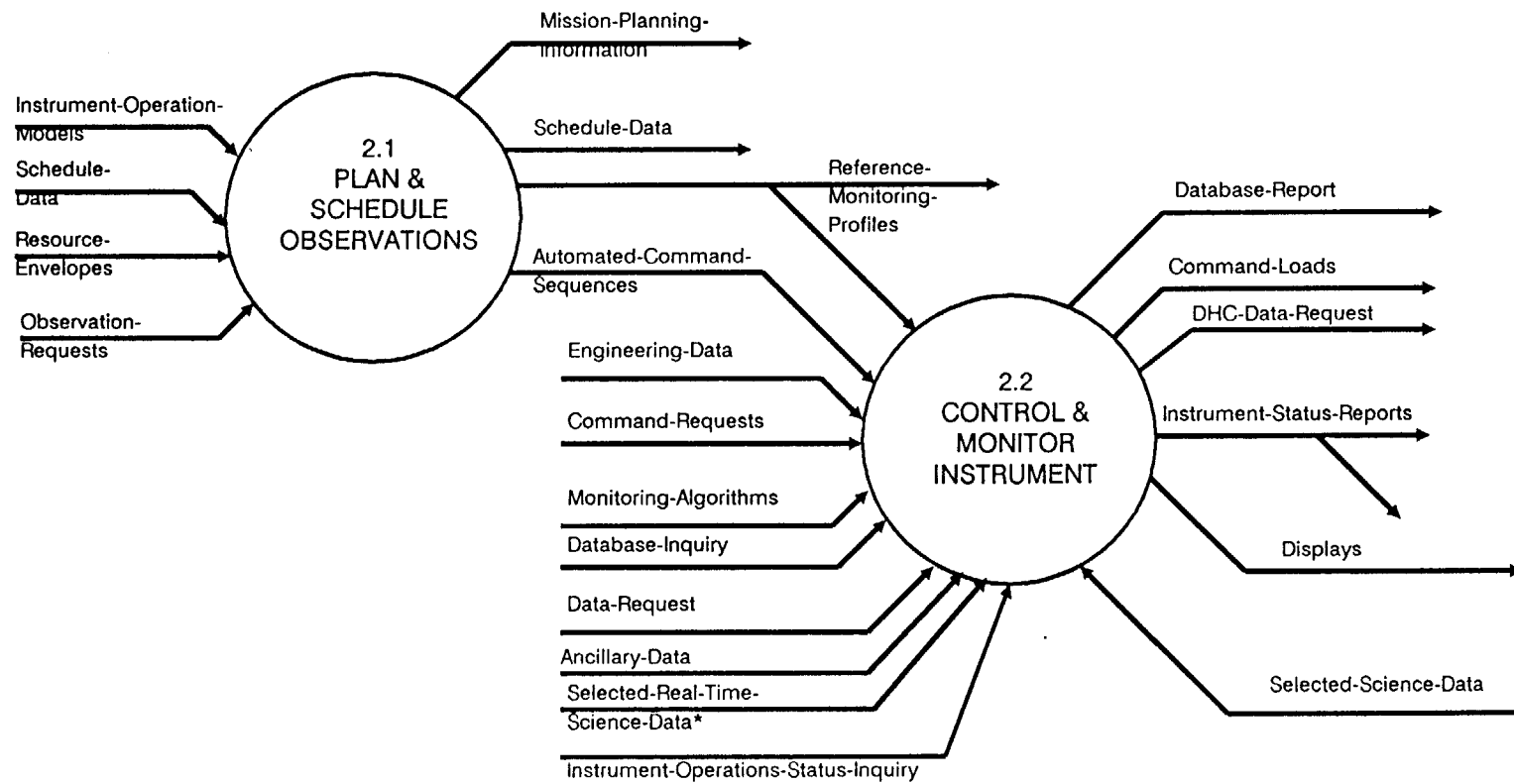
<u>MACHINE</u>	<u>TYPE</u>	<u>COMPILER OPTION</u>	<u>CPU TIME</u>	<u>MIPS</u>
IBM 3081	Scalar	No optimization	10 sec	5.3
IBM 3081	Scalar	Optimization=1	5 sec	10.6
IBM 3081	Scalar	Optimization=2	3 sec	17.7
IBM 3081	Scalar	Optimization=3	3 sec	17.7
VAX 11/780	Scalar	No optimization	122 sec	0.4
VAX 11/780	Scalar	With optimization	88 sec	0.6
CYBER 205	Scalar	No optimization	4.5 sec	11.8
CYBER 205	Scalar	With optimization	2.4 sec	22.2
CYBER 205	Vector	With optimization	.043 sec	1,238
CYBER 205	Scalar	Auto-vectorization and optimization	.043 sec	1,238

The reference capabilities for the corresponding computers are:

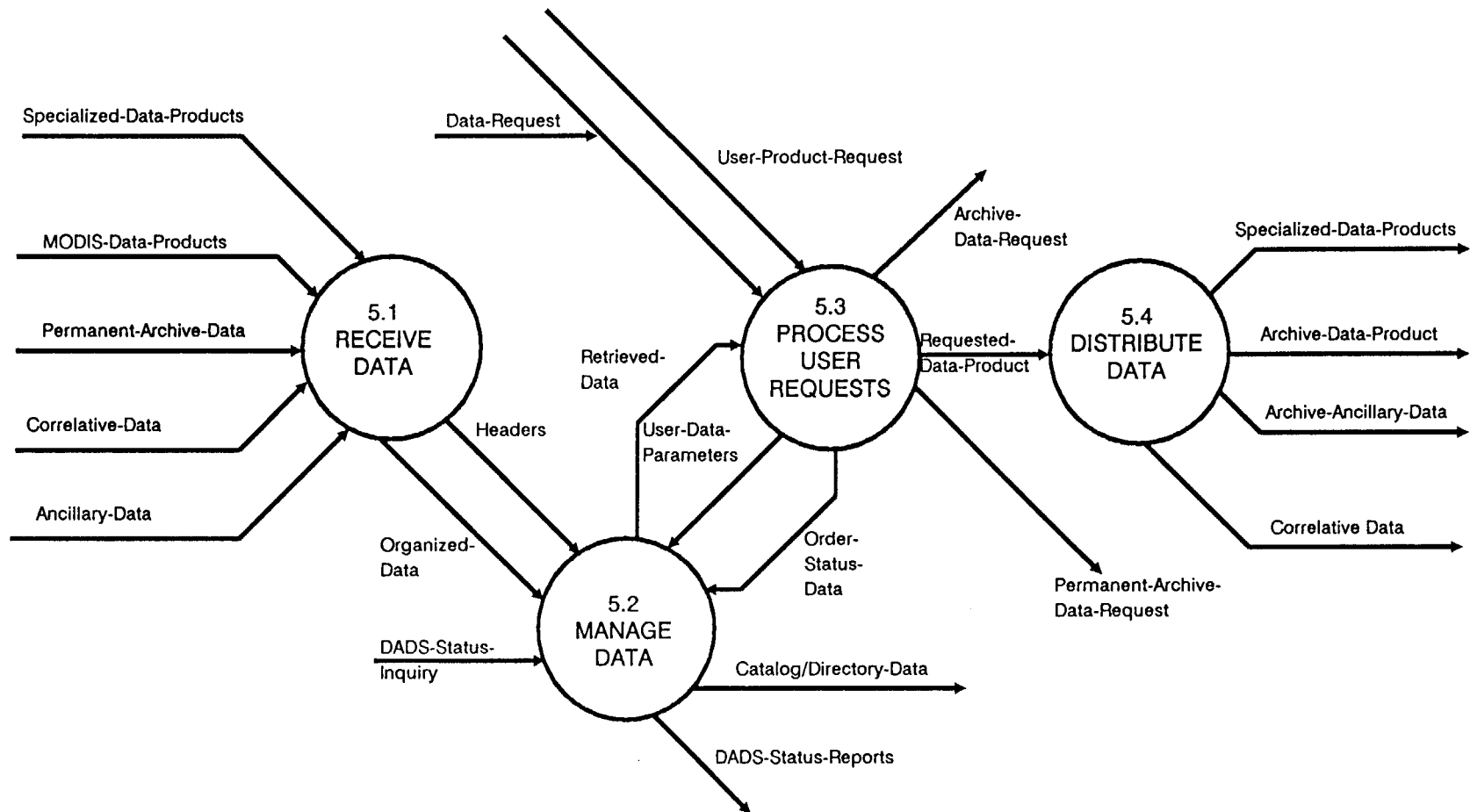
IBM 308X: 10 to 27 MIPS (IBM 3081: 14.5 MIPS)
VAX 11/785: 1 MIPS
CYBER 205: 740 MFLOPS



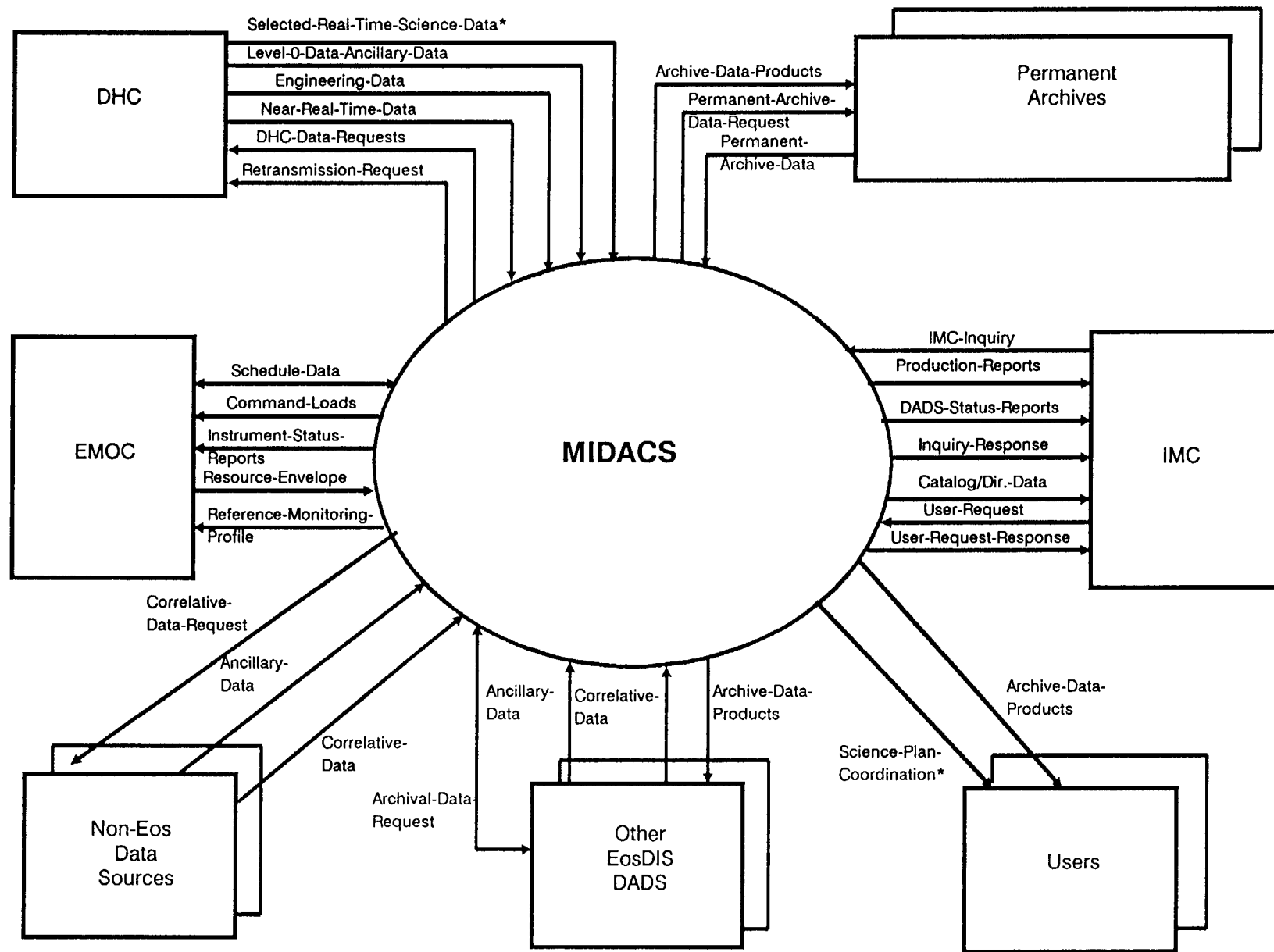
DFD 1.0 IST Functional Data Flows



DFD 2.0 ICC Functional Data Flows

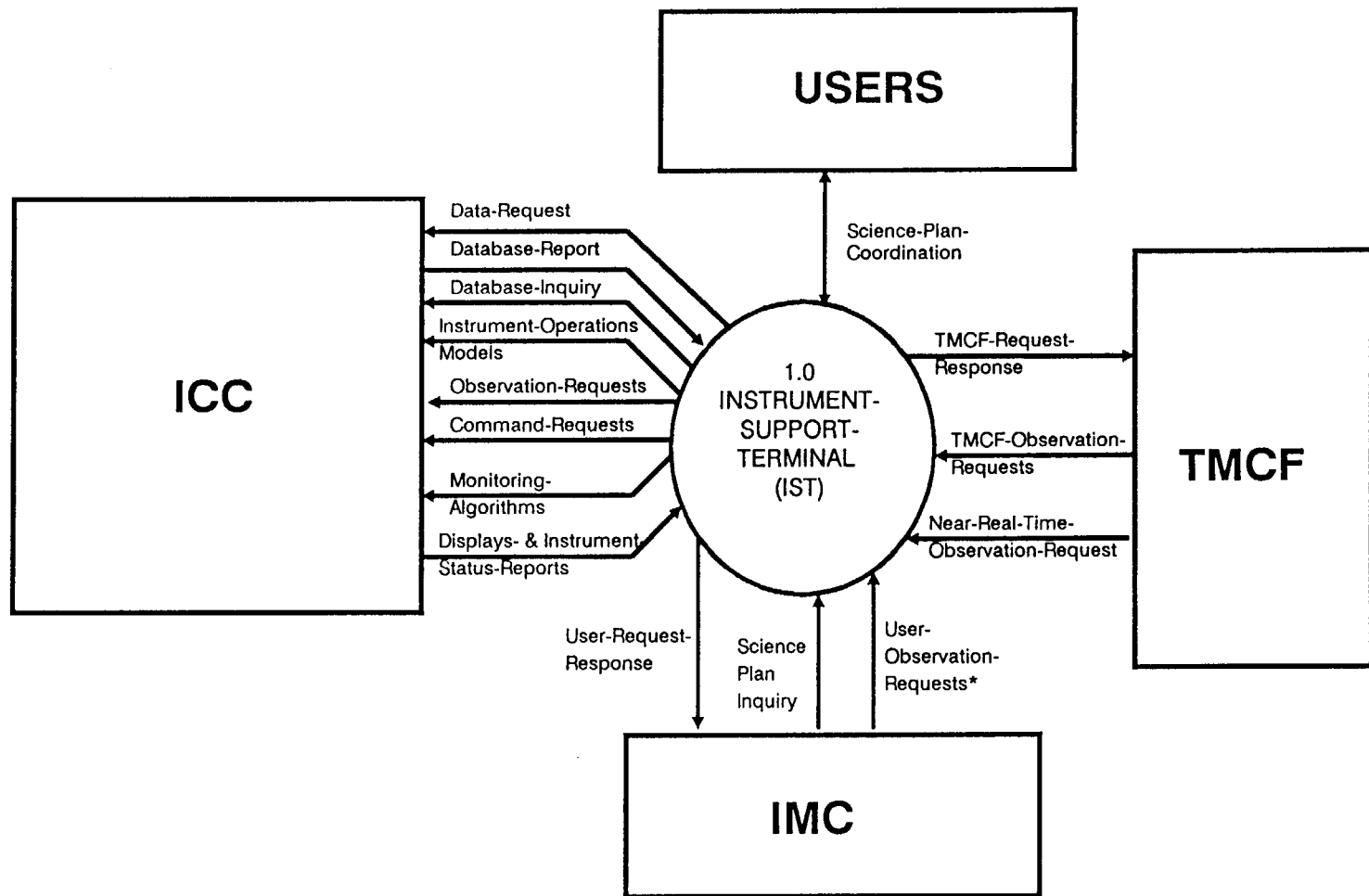


DFD 5.0 DADS Functional Data Flows



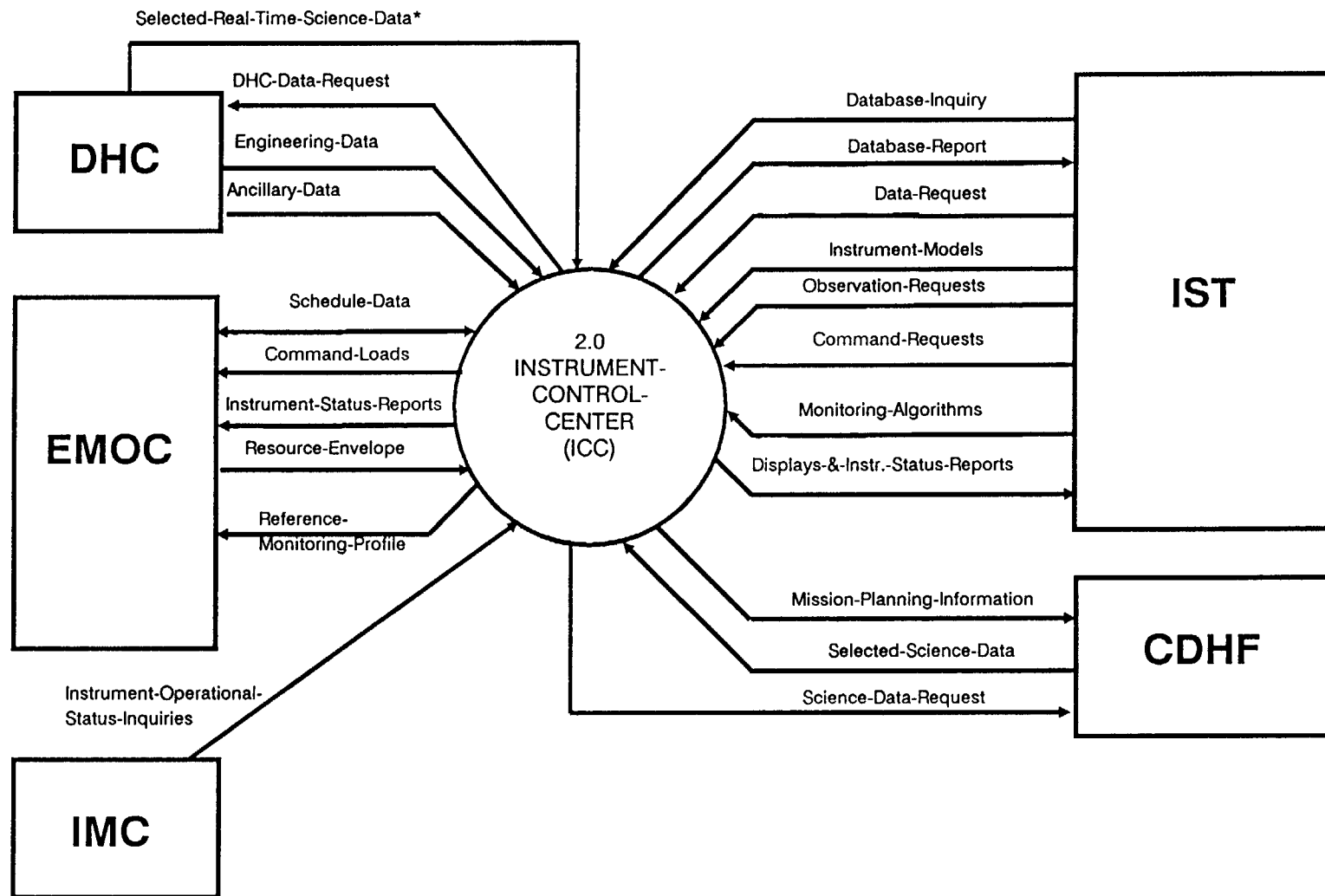
* Tentative. Issue under discussion.

MIDACS Context Diagram



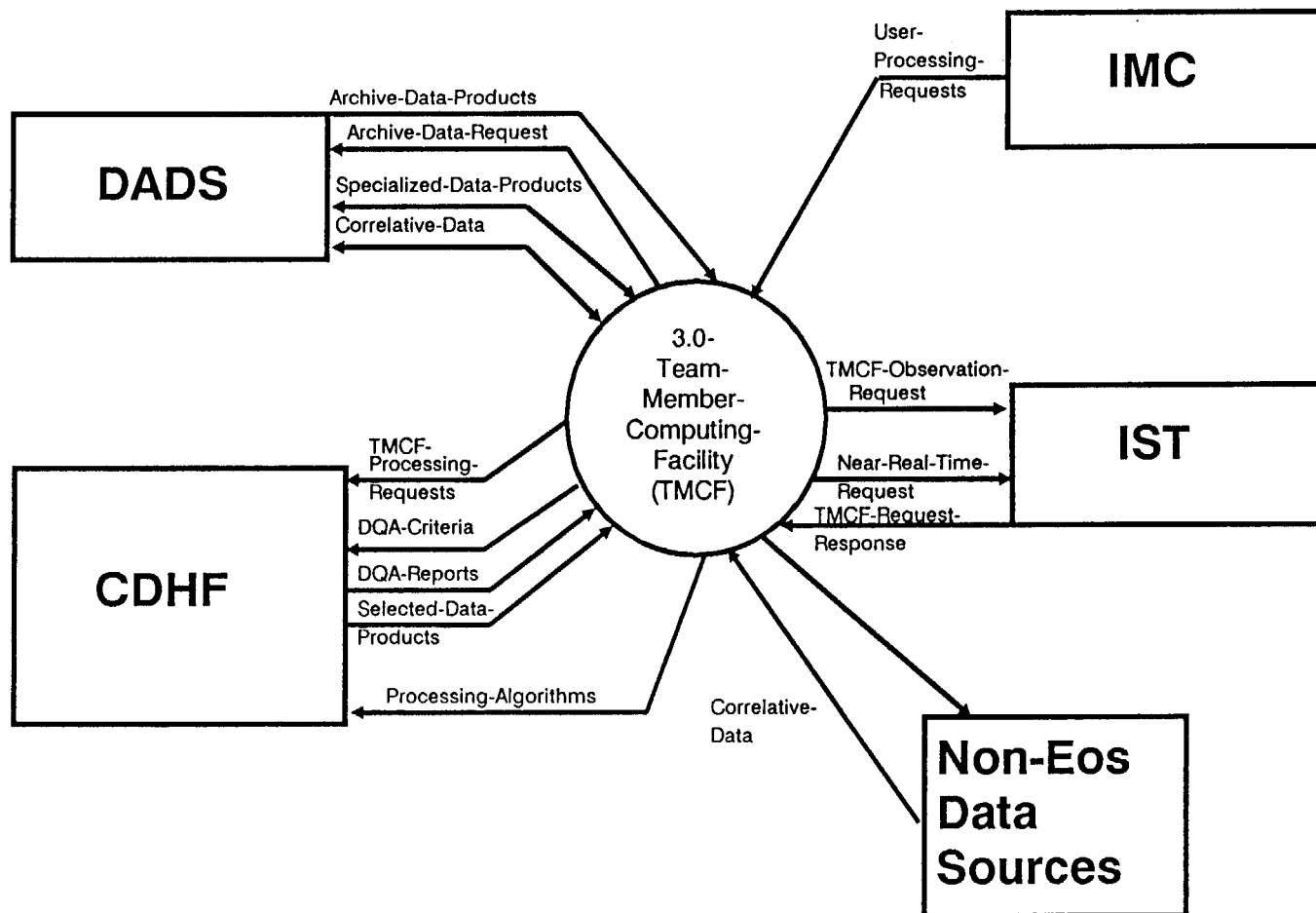
* Issue under discussion

IST Context Diagram

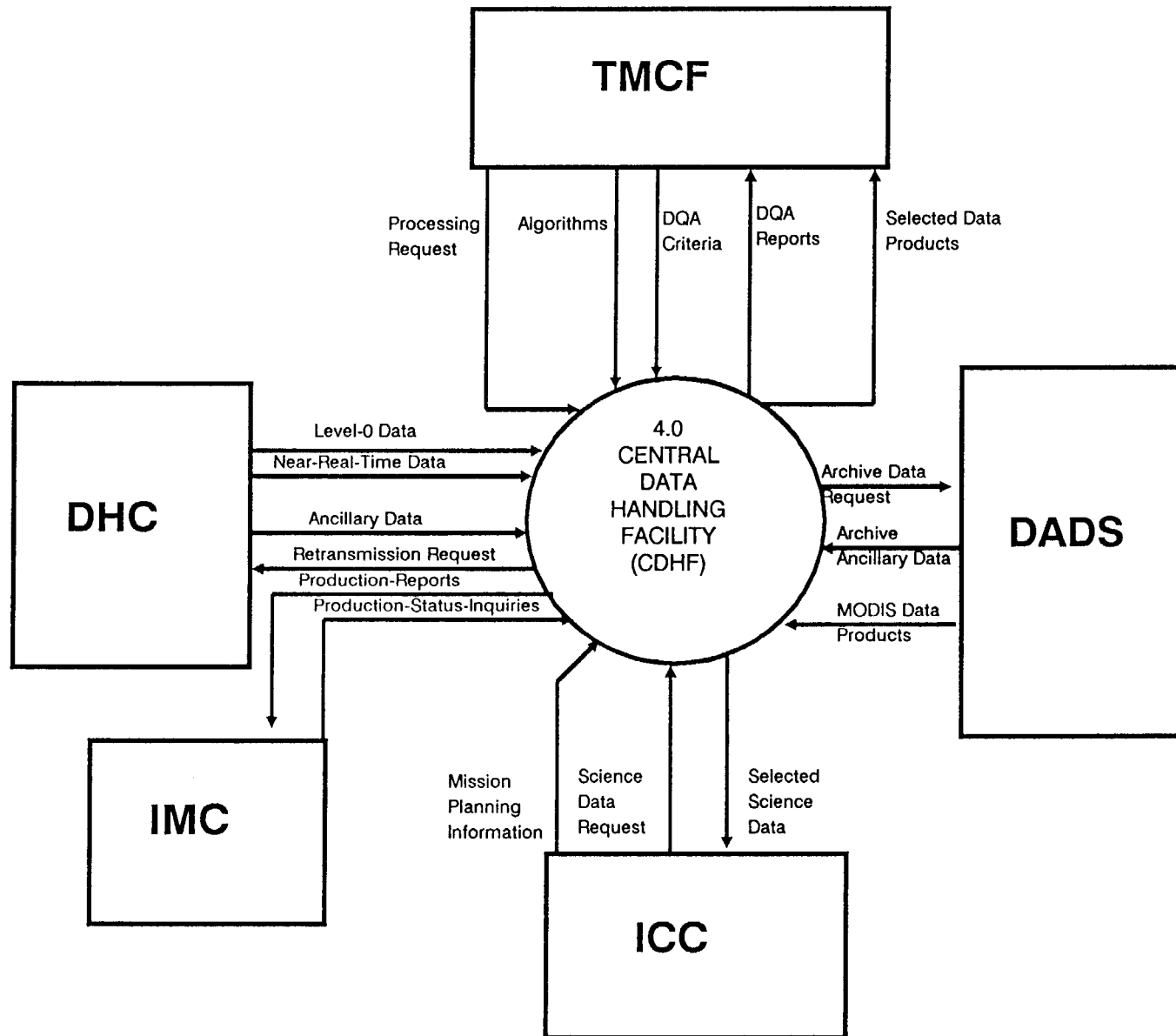


* Issue under discussion

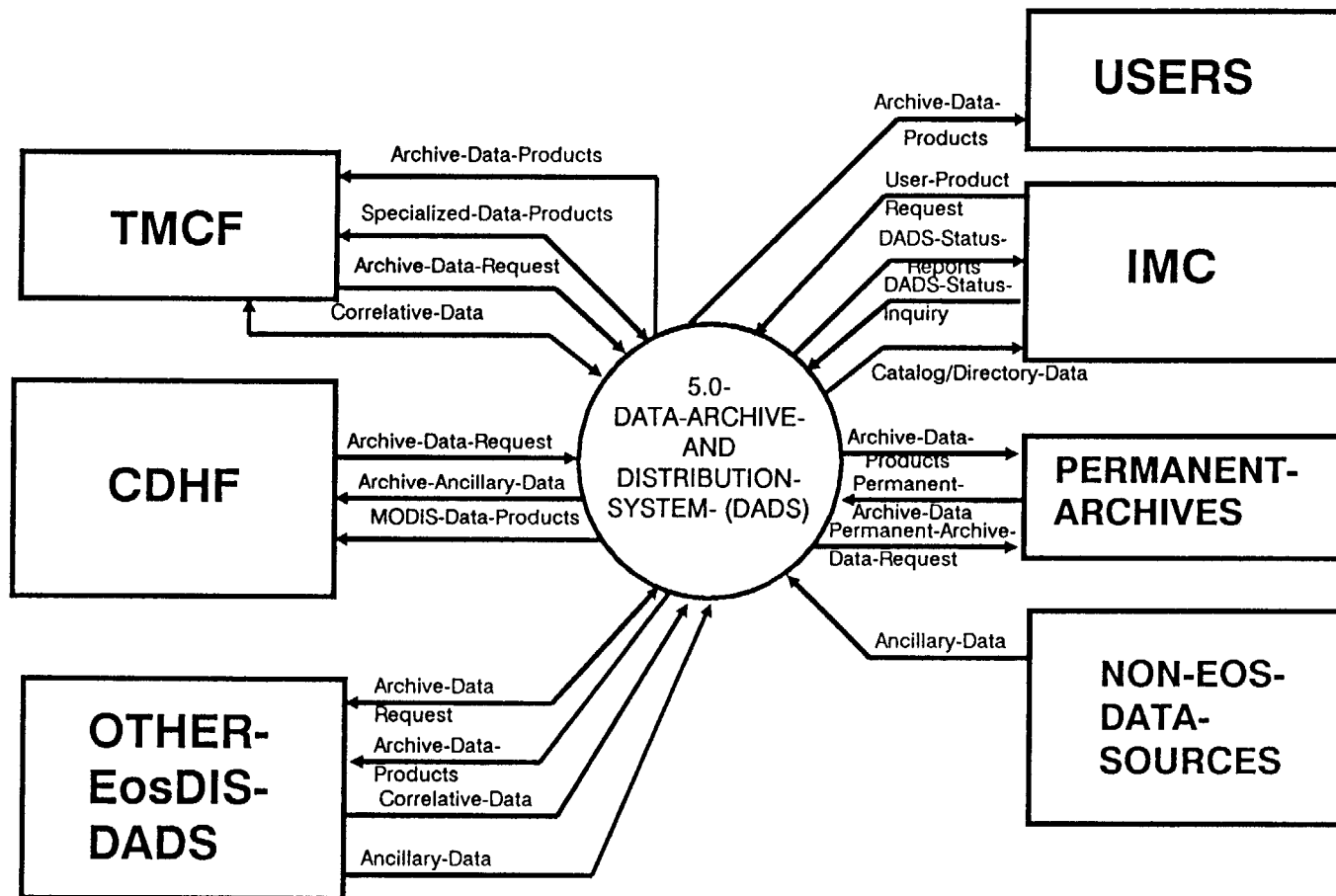
ICC Context Diagram



TMCf Context Diagram



CDHF Context Diagram



DADS Context Diagram

DATA DICTIONARY

Ancillary-Data	=	*Data other than MODIS-Instrument-Data required to perform MODIS data processing. [They include orbit data attitude data, time information, spacecraft or platform engineering data (e.g., pointing information, optics temperature, structure temperature, instrument mounting alignment), calibration data, data quality information, and data from other instruments (e.g., cloud information derived from a second instrument, status of items in a second instrument which could create interference with the instrument data being processed, map data, atmosphere temperature grids).]*
Archival-Data-Product	=	*Product generated in the CDHF that is archived for further analysis and/or distribution.*
Archival-Data-Request	=	*Data Requested from any EosDIS DADS except MODIS.*
Catalog/Directory-Data	=	*Listings of data available from the MIDACS DADS listed by platform, instrument, data processing level, algorithm identifier, parameter, time, geographic location, or combination.
Command-Loads	=	*Encoded MODIS instrument command sequences as required by the onboard MODIS instrument control system and constructed so as to affect a specific action; e.g., "HV PWR ON"..*
Command-Request	=	*A command load generated by the IST, verified by, and immediately transmitted by the ICC.*
Correlative-Data	=	*Scientific data not from the MODIS instrument used to verify, interpret, or validate MODIS data products.*
DADS-Status-Report	=	*Description of the DADS status, resources utilization, and performance.*

Database-Inquiry	=	*Inquiry of the monitoring database to determine what instrument monitoring reports, data, and analysis are currently available.*
Database-Report		*Report of instrument monitoring functions and availability.*
Data-Request	=	*A request for retrieval of archived data.*
Data-Request	=	*A request for information, data, or data products. General context is requested data may be on-line and may be shopped-for or browsed after electronically. The accounting for such data availability, transfer and/or use, may be different from that of a product order which may come from an element external to MIDACS.*
DHC-Data-Request	=	*Redesignation of packet handling and processing priorities.*
Displays-and-Instrument-Status-Report	=	*A display, (plots, images, list of requested data or status of the instrument or ground system.*
Distributed-Data-Products	=	*MIDACS products routinely archived for potential user access and distributed in response to a product request.*
DQA Criteria	=	*Factors used to assess data quality.*
DQA Reports	=	*Results of routine data quality assessment associated with data receipt and data product operations.*
Engineering-Data	=	MODIS-Engineering-Data + Platform-Engineering-Data.
Headers	=	*Information about the attributes of standard, non-standard, or data products.*
Instrument-Operations-Models	=	*Computer-compatible mathematical equivalents of the MODIS instrument, used to estimate resource requirements during a modeled operation.*

Instrument-Status-Report	=	*Information on the operating configuration of the MODIS instrument.*
Level-0-Data	=	*MODIS-Instrument-Data at original resolution, time order restored, with duplicates removed.*
Mission-Planning-Information	=	*Instrument operations schedule; information provided by the ICC to the CDHF required to verify receipt of complete data sets.*
MODIS-Engineering-Data	=	*Data other than MODIS-Science-Data generated within the MODIS instrument.*
MODIS-Instrument-Data	=	*Data originating within the MODIS instrument.*
	=	MODIS-Science-Data + MODIS-Engineering-Data
MODIS-Science-Data	=	*Unprocessed radiance observations as generated by the MODIS instrument.*
Monitoring-Algorithms	=	*A procedure (or recipe) for transforming information into a different state to accommodate a specific data interpretation.*
Near-Real-Time-Data	=	*MODIS-Instrument-Data designated for Priority Processing.*
Near-Real-Time-Request	=	*Request to handle data in Priority Mode.*
Non-Standard-Products	=	*Products not routinely produced, standard products produced by an alternate algorithm, or combinations of standard products.*
Observation-Request	=	*A special instrument measurement request not covered by the current schedule. The request is consistent with general science objectives and science mission plans and goals.*
Order-Status-Data	=	*Status and billing of the product ordered through IMC.*
	=	Order Found Status
	+	Order Placed Status

Organized-Data	=	*Data products which have been grouped according to the header.* = Level 1A data + Land data + Ocean data
Permanent-Archive-Data	=	*Data retrieved from permanent archival storage.*
Permanent-Archive-Data-Request	=	*Request for data from the permanent archive.*
Platform-Engineering-Data	=	*Data produced by the platform sensors that are used for operating the platform or as ancillary data.*
Priority Processing	=	*Immediate processing of designated data items without considering data item position in processing queues. Cf. Routine Processing.*
Processing Algorithms	=	*Calibration and Science algorithms designated by the TMCF for Standard Data Production.*
	=	Scientific Algorithms + Calibration Algorithms
Production-Report	=	Production Schedule + Production Status
Reference-Monitoring-Profile	=	*Expected MODIS instrument engineering parameter levels annotated with limits at which alarm status should be declared.*
Resource-Envelope	=	*Maximum allowable resource consumption levels for the MODIS instrument.*
Retransmission Request	=	*Request for retransmission of data packets that do not meet quality standards.*
Retrieved Data	=	*Data retrieved from DADS storage by the Process-User-Request function to fill a product order.*
Routine Processing	=	*Processing that considers data item position in data processing queues. Cf. Priority Processing.*
Schedule-Data	=	*English language descriptions of planned instrument maneuvers.*

Science-Data-Request	=	*A request for selected science data for monitoring instrument performance.*
Science-Plan-Coordination	=	*Information exchange between a User requesting special MODIS services and the MODIS Instrument Team Leader. The exchange should culminate in a plan for MODIS Instrument Operation.*
Selected-Data-Products	=	*Subsets of standard, near-real-time or specialized data product.*
Selected-Real-Time-Science-Data	=	*A subset of MODIS-Science-Data used to monitor MODIS instrument performance.*
Selected-Science Data	=	*A subset of MODIS-Science-Data used to monitor MODIS instrument performance. These data are transmitted to the ICC by the CDHF to analyze past instrument performance and is not used for real-time monitoring.*
Selected-Science-Data	=	*In response to a request, selected science data will be issued for monitoring instrument performance. Selected data may be of specific channels, time, pockets, etc.*
Special-Observation-Request	=	*An observation request which requires alteration at previously established observation plans.*
Specialized-Data-Products	=	*Data products which are considered part of a specific research investigation and are produced for a limited region or time period, or data products which are not accepted by the project as standard items.*
TMCF Observation Request	=	*Request by a TMCF member to execute a MODIS observation sequence.*
TMCF-Processing-Request	=	Standard-Processing-Requests + Reprocessing Requests + Data-Base-Inquiry + Selected-Data-Request + Product-Release-Request
TMCF-Request-Response	=	*Response of the ICC to a TMCF-Processing-Request.*

User-Observation-Request = *A special observation request not included in the current schedule but consistent with general science objectives and the science mission plan.*

User-Processing-Request = *Request by a User to generate MODIS-Data-Products not previously available.*

User-Product-Request = *Requests that distributed data products be delivered to a User from the MIDACS DADS.*

User-Request = User Product Request +
User Observation Request +
User Processing Request.

User-Request-Response = *Response to a user's request.*

ACTION ITEMS:

9/16-1: (McKay) Does MIDACS need to request Level 0 data from the DHC routinely, or will the DHC send Level 0 data to MIDACS as soon as it is ready without an explicit request?
